

CLAIMS

What is claimed is:

- 1 1. An apparatus comprising:
2 a flexible circuit having first, second, and third portions, the first portion being
3 folded on an upper surface of the third portion and having first contact elements attached to
4 a first device, the second portion being folded on the first device and having second contact
5 elements attached to a second device; and
6 a stiffener attached to the upper surface of the third portion and located between the
7 upper surface of the third portion and the first portion.
- 1 2. The apparatus of claim 1 further comprising:
2 an encapsulant to encapsulate the flexible circuit and the first and second devices.
- 1 3. The apparatus of claim 1 wherein the third portion has a lower surface
2 having third contact elements.
- 1 4. The apparatus of claim 3 wherein the lower surface is attached to at least
2 one of a printed circuit board and a third device via the third contact elements.
- 1 5. The apparatus of claim 1 wherein at least one of the first and second contact
2 elements comprise a plurality of solder pads.
- 1 6. The apparatus of claim 2 wherein the third contact elements comprise a
2 plurality of solder pads.
- 1 7. The apparatus of claim 4 wherein the first, second, and third portions
2 include first, second, and third layer having signal traces mapped to the first, second, and
3 third contact elements, respectively.
- 1 8. The apparatus of claim 1 wherein the first and second devices are identical
2 devices having solder balls attached to the first and second contact elements, respectively.

1 9. The apparatus of claim 8 wherein the identical devices are memory devices.

1 10. The apparatus of claim 1 wherein the stiffener is made of one of an
2 insulating material, a polyimide film, a mica plate, a polyester film, and a polyaramid
3 paper.

1 11. A method comprises:
2 folding a flexible circuit having first, second, and third portions, the first portion
3 being folded on an upper surface of the third portion and having first contact elements
4 attached to a first device, the second portion being folded on the first device and having
5 second contact elements attached to a second device; and
6 attaching a stiffener to the upper surface of the third portion and between the upper
7 surface of the third portion and the first portion.

1 12. The method of claim 11 further comprising:
2 encapsulating the flexible circuit and the first and second devices by an
3 encapsulant.

1 13. The method of claim 11 wherein the third portion has a lower surface
2 having third contact elements.

1 14. The method of claim 13 further comprising attaching the lower surface to at
2 least one of a printed circuit board and a third device via the third contact elements.

1 15. The method of claim 11 wherein at least one of the first and second contact
2 elements comprise a plurality of solder pads.

1 16. The method of claim 12 wherein the third contact elements comprise a
2 plurality of solder pads.

1 17. The method of claim 14 wherein the first, second, and third portions include
2 first, second, and third layer having signal traces mapped to the first, second, and third
3 contact elements, respectively.

1 18. The method of claim 11 wherein the first and second devices are identical
2 devices having solder balls attached to the first and second contact elements, respectively.

1 19. The method of claim 18 wherein the identical devices are memory devices.

1 20. The method of claim 1 wherein the stiffener is made of one of an insulating
2 material, a polyimide film, a mica plate, a polyester film, and a polyaramid paper.

1 21. A module comprising:
2 a first device and a second device; and
3 a stacking element to stack the second device on the first device, the stacking
4 element comprising:
5 a flexible circuit having first, second, and third portions, the first portion
6 being folded on an upper surface of the third portion and having first
7 contact elements attached to the first device, the second portion being
8 folded on the first device and having second contact elements attached to
9 the second device, and
10 a stiffener attached to the upper surface of the third portion and located
11 between the upper surface of the third portion and the first portion.

1 22. The module of claim 21 wherein the stacking element further comprising:
2 an encapsulant to encapsulate the flexible circuit and the first and second devices.

1 23. The module of claim 21 wherein the third portion has a lower surface
2 having third contact elements.

1 24. The module of claim 23 wherein the lower surface is attached to at least one
2 of a printed circuit board and a third device via the third contact elements.

1 25. The module of claim 21 wherein at least one of the first and second contact
2 elements comprise a plurality of solder pads.

1 26. The module of claim 22 wherein the third contact elements comprise a
2 plurality of solder pads.

1 27. The module of claim 24 wherein the first, second, and third portions include
2 first, second, and third layer having signal traces mapped to the first, second, and third
3 contact elements, respectively.

1 28. The module of claim 21 wherein the first and second devices are identical
2 devices having solder balls attached to the first and second contact elements, respectively.

1 29. The module of claim 28 wherein the identical devices are memory devices.

1 30. The module of claim 21 wherein the stiffener is made of one of an
2 insulating material, a polyimide film, a mica plate, a polyester film, and a polyaramid
3 paper.